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1741 AF

IN THE PATENT AND TRADEMARK OFFICE

Appeal brief in triplicate for:

Serial: 09/405,781

Filed: Sept. 27, 1999

For: APPARATUS AND METHOD FOR PURIFYING AIR

Inventor: George Benda

Group art unit: 1741

Examiner: T. Tran

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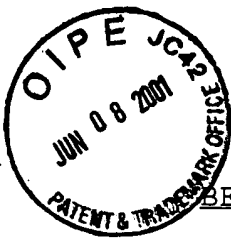
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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IN THE APPLICATION OF:)
GEORGE BENDA) GROUP ART UNIT: 1741
SERIAL NO.: 09/405,781) EXAMINER: T. Tran
FILED: Sept. 27, 1999)
FOR: APPARATUS AND)
METHOD)
FOR PURIFYING AIR)

BRIEF ON APPEAL

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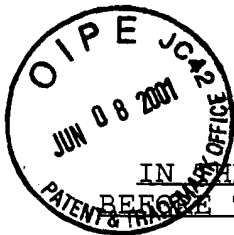
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FILED: Sept. 27, 1999)
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FOR: APPARATUS AND)
METHOD)
FOR PURIFYING AIR)

BRIEF ON APPEAL

The Honorable Commission of Patents and Trademarks
Washington D.C. 20231

Sir:

This is an appeal from a final rejection under 35 U.S.C.
§102(e) and 35 U.S.C. §103 of claims 1-15 of the above identified
application.

I. REAL PARTY IN INTEREST

5 The real party in interest is Chelsea Group Ltd., One Pierce
Place, Suite 475E, Itasca, Il. 60143.

II. RELATED APPEALS AND INTERFERENCES

10 No appeal in this application or any related application was
previously before the Board or any appellate court. No related
case is pending before the Board or in the Federal Circuit or any

other court. There is, and have been, no interferences in this case.

III. STATUS OF CLAIMS

This is an original utility application filed Sept 27, 1999
5 for an "Apparatus and Method for Purifying Air". The application serial number is 09/405,781. Claims 1-15 remain pending.

Claims 1, 3, 6-7, and 9 stand rejected under 35 U.S.C. §102(e) as anticipated by, or in the alternative under 35 U.S.C. §103(a) as obvious over, Goswami (US Pat. 5,835,840). Claims 1,
10 3-14 stand rejected under 35 U.S.C. §102(e) as anticipated by, or in the alternative under 35 U.S.C. §103(a) as obvious over, Yamanaka et al. (US Pat. 5,919,422). Claims 2, 10-11 and 13-14 are rejected under 35 U.S.C. §103(a) as being unpatentable over Goswami. Claim 15 stands rejected under 35 U.S.C. §103(a) as
15 being unpatentable over Yamanaka et al. Claims 2 and 10 are rejected under 35 U.S.C. §103(a) as being unpatentable over Goswami as applied to claim 1 and in further view of Dimitrik (U.S. Pat. 3,844,741). Claim 21 was canceled in an amendment after final rejection under 37 C.F.R. §1.116.

IV. STATUS OF AMENDMENTS

The original application was filed with 21 claims. In response to a restriction requirement claims 1-15 and 21 were

elected. A first office action rejected claims 1-15, and 21. An amendment was filed in response to the first office action amending claims 1-2, 6-7, 10, 15 and 21. A final office action was received rejecting claims 1-15 and 21. An amendment under 37 C.F.R. §1.116 was filed along with notice of this appeal canceling claim 21. Thus claim 1-15 remain pending in this appeal.

V. SUMMARY OF THE INVENTION

The invention relates generally to the field of air quality and more particularly to an apparatus and method for purifying air in a room.

The invention is a portable, plug-in device and method that needs no moving parts. It can plug into a wall electrical outlet to purify air in a room. Fig. 1 shows a perspective view of the invention.

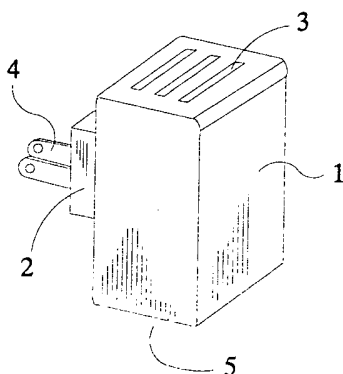


Fig. 1

A casing or container 1 contains the invention. Electrical prongs 4 allow the unit to be directly plugged into an electrical outlet. A chamber 2 contains power conversion for a heater pad and UV lamp. Room air is drawn into the bottom of the device 5 and is expelled from vents 3 on the top. Fig. 2 shows the internal construction of the invention.

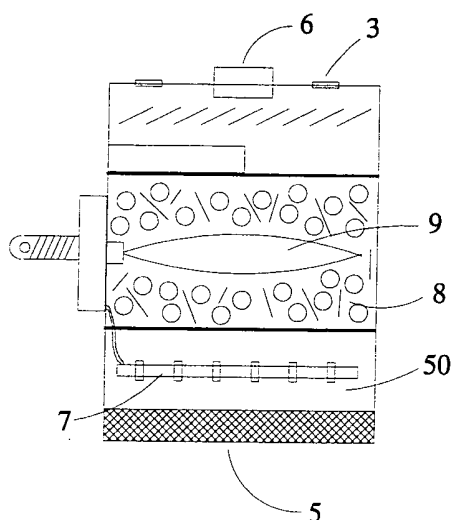


Fig. 2

The invention causes air to pass through a vertical passage-
way or chimney (reactor) 50 that contains a catalyst 8 that can be

activated by an ultraviolet light source 9. Ambient room air is caused to enter the device and move upward by a process of natural convection where no external force such as a fan needs to be used. Natural convection occurs when air is heated by a hot
5 body and hence becomes less dense than colder surrounding air. The less dense air experiences an increase in upward buoyancy force which causes it to move upward. The present invention contains a small heater or heat element 7 in a vertical passageway or chimney (reactor) 50. Cold air enters the apparatus
10 through slots or openings at the bottom of the device 5.

The slightly heated air passes up through the chimney or reactor passageway 50 where it encounters a catalyst 8 such as titanium dioxide, either in pure form, or doped with any of several materials. The catalyst can be activated by an
15 ultraviolet light source 9 that emits light with a wavelength or spectrum shorter than around 387 nanometers (which is the activation energy of pure titanium dioxide in the anatase crystal form), or a wavelength shorter than the activation energy of whatever catalyst is used. The light source is optional, and is
20 not needed with some types of catalysts.

The catalyst is held in the chimney in a form which exhibits a large surface area to allow maximum exposure of the air that is convecting upward. The catalyst can be coated on a flat sheet which in turn can be spiraled on a loose spool to obtain more
25 surface area of exposure, or the catalyst can be impregnated on

fibers which can be formed into a fibrous mass (an example of such fibrous mass might be like fiberglass insulation or a like fiber). The fibers can be natural or synthetic organic materials, or can be glass such as fiberglass. Any means of holding the photocatalyst in position so that air passing upward in the chimney makes contact with it is within the scope of the present invention.

The ultraviolet light source 9 that is used to activate the catalyst can be a commercial UV light bulb, a fluorescent lamp (which leaks considerable UV light), or a means of allowing sunlight to enter the device. If a UV bulb is used, an optional power supply usually must be used to supply the bulb voltage.

The invention contains an exit port on its top which can be a small jet 6 or slots 3 to allow the upward convecting, purified air to re-enter the room. This port can contain an optional baffle to prevent UV light from entering an observer's eyes. This type of protection is necessary for safety if wavelengths shorter than about 340 nanometers are used. It may also be desirable in some cases to prevent any visible light produced by the UV source from exiting the device. In other cases, it may be desirable to allow visible light to exit the device so that the present invention can also be used as a night light at the same time as it purifies the air.

The invention can be equipped with two electrical prongs 4

on its back side so that it can be directly plugged into a standard 110 V. electrical outlet, or, optionally, it can have a power cord. Power from the electrical outlet can be used to supply energy to both the heater and to the ultraviolet light source.

The present invention purifies air in a room over a span of hours since the rate of natural convection is slow. The invention can kill bacteria and can convert organic compounds such as volatile organics (VOC's), odor causing organics, hydrocarbons, and other undesirable compounds into smaller, less harmful or odorous, compounds such as carbon dioxide, water.

VI. ISSUES PRESENTED

1. Did the examiner properly construe the claims on appeal?

2. Did the examiner apply an erroneous standard of anticipation under 35 U.S.C. §102(e) as construed in Carella v. Starlight Archery and Pro Line Co., 231 U.S.P.Q. 644 (Fed. Cir. 1986) and Mehl/Biophile International Corp. v. Milgraum, 52 U.S.P.Q.2d 1303 (Fed. Cir. 1999) to the claims on appeal?

3. Are the differences between the subject matter claimed and the prior art such that the subject matter as a whole would have been obvious at the time the invention was made to a

person having ordinary skill in the art?

4. Did the examiner apply an erroneous standard rather than the statutory test of obviousness provided in 35 U.S.C. §103 and construed in Graham v. John Deere Company, 383 U.S. 1, 148 U.S.P.Q. 459 (1966)?

VII. GROUPING OF CLAIMS

The rejected claims on appeal do NOT "stand or fall" together. Claims 1, 3-9 may be grouped to stand or fall together, and claims 2, 10-15 may be grouped to stand or fall together.

The first group, claims 1, 3-9 claim the basic invention using convection to draw air past a photocatalyst.

The second group, claims 2, 10-15 claim the basic invention with the additional limitation of protruding electrical prongs where the device can be directly held in a wall electrical outlet.

VIII. ARGUMENT

A. THE EXAMINER FAILED TO PROPERLY CONSTRUE THE CLAIMS

1. THE CLAIMED INVENTION

Claims 1-2 recite the following elements:

1. A device for purifying air comprising:

a reactor;

a photocatalyst located in said reactor;

an ultraviolet light source located in said reactor, said
ultraviolet source illuminating said photocatalyst;

a heater means located in said reactor for drawing air
into said reactor by convection and causing said air to
rise past said photocatalyst before being expelled.

2. The device for purifying air of claim 1 further compris-
ing a pair of electrical prongs protruding from said de-
vice, said electrical prongs allowing said device to be
directly plugged into an electrical outlet.

Claims 3-9 depend from claim 1, incorporate its elements by
reference and add further recitations (see Appendix A and the
description below).

Claim 10 recites the following elements:

10. A compact device with a base and a top for purifying
air that is plugged directly into a wall power outlet
comprising a set of power prongs protruding from the device
for plugging into a wall outlet, a compartment containing a
photocatalyst that is illuminated by an ultraviolet light
source, an opening at the base of the device for air to
enter, a heater means in the device near this opening for
heating air entering the device and causing this air to
rise past the illuminated photocatalyst, the air becoming
purified, and an exit port at the top of the device for the
purified air to exit.

Claims 11-15 depend from claim 10, incorporate its elements
by reference, and add further recitations.

2. THE REJECTION OF THE CLAIMS ON APPEAL

The examiner rejected the claims on appeal under 35 U.S.C.

§102(e) and 35 U.S.C. §103(a). As to claims 1, 3, 6-7, and 9, the examiner applied the Goswami reference as follows:

5 Goswami teaches a device for purifying air comprising: a reactor (system) comprising a photocatalyst; an ultraviolet light source, illuminating the photocatalyst; and a heater means (heating coil) (see Figs. 1-3; col 3-4, lines 62-67). The reference further teaches the warm air passing the photocatalyst before being expelled (see Fig. 1).

10 Although Goswami is silent with respect to the heater means for drawing air into the reactor by convection and causing the air to rise past the photocatalyst before being expelled, it has been known within the skill in the art that
15 when there is a heating means in a reactor, the air around the heating means would have been inherently caused to rise and this in turn would have inherently caused cooler air from outside to move into the reactor.

(Page 3 of the Final Office Action).

The examiner applied the Yamanaka reference as follows:

20 In regards to claims 1 and 10, Yamanaka teaches a device for purifying air, comprising a reactor (photocatalyzer) which comprises a photocatalyst, and ultraviolet light source, a heater means, and an exit port (outlet port) (see abstract; Fig. 10; col. 21, lines 6-12); claims 1-3).

25 With respect to the function of the heater, the arguments are as set forth in paragraph 6 above.

(Page 4 of the Final Office Action. (Note: the examiner's reference to paragraph 6 above refers to the paragraph above cited from page 3 of the Final Office Action)).

30 The examiner also answered the applicant's arguments included in an amendment filed after the first office action as follows:

On page 8 of the Arguments, applicant contends that neither Goswami nor Yamanaka teaches a heater means for causing air

to rise by convection. This contention is correct. However, as pointed out in paragraph 6 of this Office Action, it has been known that when there is a heat generator, the air around the heater will rise by convection due to an increase in entropy. This upward movement of the air molecules around the heater, in turn, will cause cooler air in other areas, usually outside or below the heater, to move towards the heater, where the molecules absorb heat and rise upward. The whole process of air movement will repeat in the manner mentioned above. Therefore, although neither Goswami nor Yamanaka uses the same functional language as that in the instant claims, since this is an inherent characteristic, Goswami's and Yamanaka's heater means would inherently have the same function as that in the instant claim.

(Page 6 of the Final Office Action (underlining is by applicant for purposes of this appeal and was not in the office action)).

The examiner failed to properly construe the claims on appeal. He dismissed a material element as an inherent effect, and he did not properly construe the means plus function recitations in the claims.

3. THE ERRORS IN CLAIM CONSTRUCTION

a. THE EXAMINER DISMISSED A MATERIAL ELEMENT AS AN INHERENT EFFECT

The examiner dismisses the stated function of the heater element e.g. drawing air past the photocatalyst as one of inherent effect. Every element or recitation of a claim is a material element that the examiner must consider. Lemelson v. United States, 752 F.2d 1538, 1551, 224 U.S.P.Q. 526, 533 (Fed. Cir. 1985). The examiner did not cite prior art concerning this recitation. This recitation gives meaning to the claims and properly defines the invention. Thus, the examiner should have considered it.

b. THE EXAMINER DID NOT PROPERLY CONSTRUE THE MEANS PLUS
FUNCTION RECITATIONS

Section 112, paragraph six, of Title 35 of the United States Code provides that:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

In In re Donaldson Company, inc., 16 F.3d 1189, 29 U.S.P.-Q.2d 1845, the Court of Appeals for the Federal Circuit held that paragraph six applies regardless of the context in which the interpretation of the mean plus function language arises.

Thus, to properly construe the means plus function recitations of the claims, the examiner must review the specification to identify the structure covered by the "heater means for

drawing air into said reactor by convection" recitation. The examiner must then determine if the prior art contains the same or equivalent structure for performing the same function. While the prior art contains heaters, they do not perform the same function. In Goswami, heater coils 56 and 58 (*Goswami Figs.1-3*) are part of a building furnace. Yamanaka mentions a heater in only his eighth embodiment where he discusses an air conditioner/heater of a car (col. 21, lines 7-23).

Thus, the examiner has not found the corresponding structure in the prior art performing the same or an equivalent function. This is an improper construction of means-plus function claims.

B. THE EXAMINER APPLIED AN ERRONEOUS STANDARD OF ANTICIPATION

The examiner rejected claims 1, 3, 6-7, and 9 under 35 U.S.C. §102(e) as anticipated by Goswami and claims 1, 3-14 as anticipated by Yamanaka et al.

The examiner states "the air around the heating means would have been inherently caused to rise and this in turn would have inherently caused cooler air from outside to move into the reactor." As to anticipation, the examiner appears to be invoking the doctrine of inherent disclosure or inherency.

The Court of Appeals for the Federal Circuit has clearly taught that anticipation requires recitation of every element of a claim by a prior art reference. Lemelson 224 U.S.P.Q. 526 at 533. "All of the elements and limitations of the claim [must] be

found within a single prior art reference.", carella v. Starlight Archery and Pro Line Co., 804 F.2d 135, 138, 231 U.S.P.Q. 644, 646 (Fed. Cir. 1986). "A prior art reference must disclose every limitation of the claimed invention, either explicitly, or inherently, to anticipate.", In Re Schreiber, 128 F.3d 1473, 1477, 44 U.S.P.Q.2d 1429, 1431 (Fed. Cir. 1997).

The doctrine of inherency allows a prior art reference to anticipate a claim if it intrinsically, rather than explicitly, discloses a subsequently claimed invention. However, the intrinsic feature or limitation must actually be present in the prior art reference even though it is not explicitly disclosed. "To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." Continental Can Co. v. Monsanto co., 948 F.2d 1264, 20 U.S.P.Q.2d 1746 (Fed. Cir. 1991) (quoting In re Oelrich, 666 F.2d 578, 581, 212 U.S.P.Q. 323, 326 (CCPA 1981) and Hansgirk v. Kemmer, 102 F.2d 212, 214, 40 U.S.P.Q. 665, 667 (CCPA 1939).

Anticipation by inherent disclosure requires a prior art reference to necessarily function in accordance with, or include,

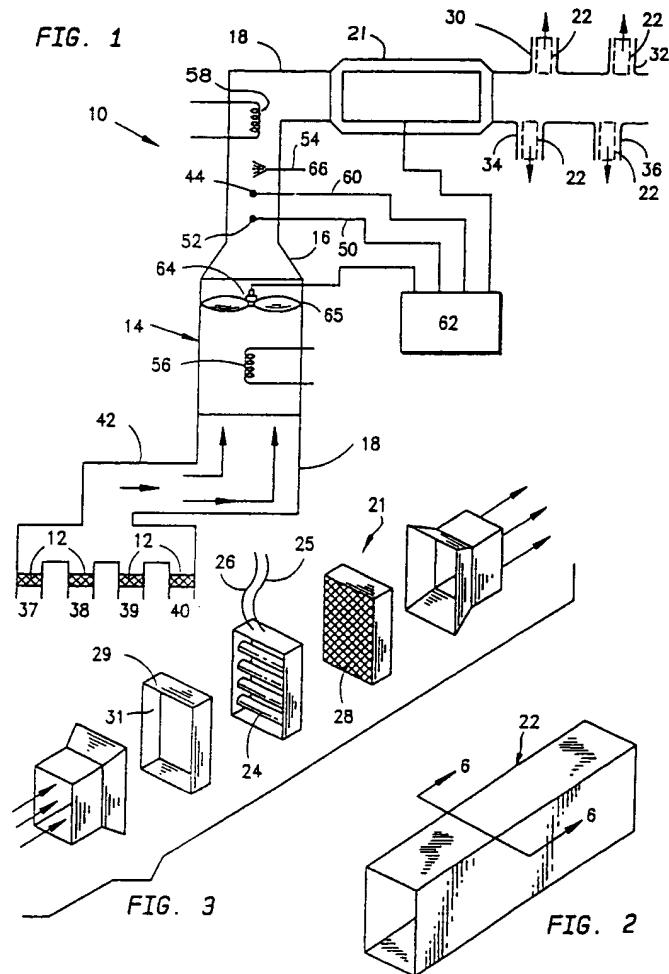
all the limitations of the claimed invention. Mehl/Biophile International Corporation v. Milgraum, 193 F.3d 1362, 52 U.S.P.Q.2d (Fed. Cir. 1999).

Because neither the device of Goswami nor the embodiments of Yamanaka et al. make any use of heated air rising by convection, nor contain any such element, this very important feature of the applicant's invention cannot be inherent in these references. Therefore, all of the claims rejected under 35 U.S.C. §102(e) were improperly rejected because the examiner applied an erroneous standard of anticipation. Neither prior art reference contains this limitation explicitly or implicitly as required by the standard.

C. THE PRIOR ART DOES NOT RENDER OBVIOUS THE CLAIMS ON APPEAL AND THE EXAMINER APPLIED AN ERRONEOUS STANDARD OF OBVIOUSNESS

1. THE PRIOR ART DOES NOT CONTAIN NOR SUGGEST THE INVENTION

The Goswami reference discloses an air purification system for a building to be installed in new or already installed duct systems [Goswami col. 2, line 65]. Figures 1-2 of this reference are reproduced for clearer understanding in this appeal.



Goswami Figs. 1-3

Goswami contains a fan 65 that forces air into ducts past building heating coils 58 and 56. A duct can contain a bank of UV lamps 24 and a mesh or coated liner 28 containing catalyst.

5 The building heating coils are used to heat the building and have nothing to do with air purification or Goswami's invention.

Goswami only mentions the heating coils once [Goswami col. 4, line 7].

5 The Yamanaka et al. reference teaches numerous embodiments containing combinations of ultra-violet lamps (or sunlight in some embodiments) providing light to Titanium Dioxide catalyst in various configurations. Yamanaka et al. only mention a heater in one embodiment, where they mention that cars have a heater core [103 in Yamanaka Fig. 10, mentioned col. 21, line 11, eighth embodiment]. As with Goswami, Yamanaka et al. make no use of the
10 heater mentioned in their invention. In fact, no heater appears in any of the 21 embodiments of Yamanaka et al. except the mention that air in a car system passes through an air conditioner/heater core and damper [again Yamanaka col. 21, lines 20-23].

15 The applicant teaches and claims a heater means that causes air to rise and pass by a catalyst by natural convection. "Cold air can enter the apparatus through slots or openings at the bottom of the device. A heater or heat element can be placed above the air entrance port This heater causes natural
20 convection to take place. As the warmer air moves upward, a pressure gradient is formed which in turn draws more cool air into the device. The slightly heated air passes up through the chimney or reactor passageway where it encounters a photocatalyst ..." [Applicant's Specification, page 3, lines 1-9]. "...[a]
25 heater means located in said reactor for drawing air into said reactor by convection and causing said air to rise past said

photocatalyst before being expelled..." [applicant's claim 1].

Since neither prior art reference contains a heater element, or requires that the air passing the catalyst be hot, it is impossible for the cited references, either alone or combined, to render the applicant's invention obvious. The references, in fact, TEACH AWAY from the applicant's invention because they both use COLD air during summer when air conditioning is in use instead of heat. Goswami teaches a building furnace which is off in summer, and Yamanaka et al. teach a car heater which is also off in summer.

2. THE EXAMINER DID NOT APPLY THE STATUTORY STANDARD OF OBVIOUSNESS

For the reasons outlined above, the Goswami reference and the Yamanaka reference do not render the claimed invention obvious when applied separately or collectively. Neither reference discloses or suggests the use of natural convection as a means for moving air past a catalyst.

In the final action, the examiner has merely stated that it is a known fact that air around a heater will rise: "it has been known that when there is a heat generator, the air around the heater will rise by convection due to an increase in entropy. This upward movement of the air molecules around the heater, in turn, will cause cooler air in other areas, usually outside or below the heater, to move towards the heater, where the molecules absorb heat and rise upward." [Final office action, page 6, under

Response to Arguments].

The examiner then simply dismisses the convection process as somehow inherent even though neither Goswami nor Yamanaka need, or always use heated air:

5 "Therefore, although neither Goswami nor Yamanaka uses the same functional language as that of the instant claims, since this is an inherent characteristic, Goswami's and Yamanaka's heater means would have the same function as that in the instant claim."
[Final office action, page 6, under Response to Arguments].

10 The correct standard of obviousness is whether "the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains". Graham v. John Deere,
15 383 U.S. 1, 148 U.S.P.Q. 459 (1966). Also, "Obviousness cannot be established by combining pieces of prior art absent some 'teaching, suggestion, or incentive supporting the combination'." In re Geiger, 815 F.2d 686, 688, 2 U.S.P.Q.2d 1276, 1278 (Fed. Cir. 1987).

20 The examiner has failed to show that the subject matter as a whole would have been obvious at the time the invention was made, because he has failed to find any teaching or suggestion of using a heater in an air purifying device to cause air to circulate through the device past a catalyst by natural convection, thus
25 causing the air to become purified. The examiner has thus not made out a prima facie case of obviousness.

While the examiner did not actually try to combine Goswami

with Yamanaka et al in the final action, that too is impossible because there is no teaching in either reference to use convection to move air. Combining would still result in a system with heaters only used for standard heating purposes and fans to move
5 air.

The examiner also rejected claims 2 and 10 as being unpatentable over Goswami as applied to claim 1 in further view of Dimitrik (U.S. Pat. 3,844,741). Claims 2 and 10 add a further limitation to the applicant's basic invention where electrical
10 prongs protrude directly from the device and allow the device to be plugged directly into the wall where the wall-plug then supports the device.

The applicant acknowledges that there are numerous devices that plug directly into the wall and have electrical prongs
15 protruding. With the Dimitrik reference, the examiner has merely showed that something with electrical prongs is known in the art. Dimitrik, in fact, teaches an electrical plug with prongs on the end of a power cord which is quite old in the art. Dimitrik does not even mention prongs on the actual device for direct plugging
20 and support. With this rejection, the examiner has merely shown the invention employs known components and principles, e.g., electrical prongs, air convection, etc. Such a showing, however, does not prove that the invention would have been obvious -- most inventions employ known components and principles. Lindemann
25 Maschinenfabrik GMBH v. American Hoist & Derrick Co., 730 F.2d 1452, 1462, 221

U.S.P.Q. 481, 489 (Fed. Cir. 1984). The examiner here is using a shopping list approach.

IX. CONCLUSION

In view of the foregoing, the applicant respectfully re-
5 requests that the Board reverse the Examiner's final rejection of
claims 1-15, and allow these claims.

X. PERFECTION ON APPEAL

The applicant submits this brief in triplicate. The appli-
cant has submitted a check in the amount of \$310.00 including
10 \$155.00 for a notice of appeal pursuant to 37 C.F.R. §1.17(b) and
\$155.00 for filing of this brief pursuant to 37 C.F.R. §1.17[©]
(the applicant is a small entity).

Respectfully submitted

15 

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CLAIMS ON APPEAL

Claims on Appeal

1. A device for purifying air comprising:

a reactor;

5 a photocatalyst located in said reactor;

an ultraviolet light source located in said reactor, said ultraviolet source illuminating said photocatalyst;

10 a heater means located in said reactor for drawing air into said reactor by convection and causing said air to rise past said photocatalyst before being expelled.

2. The device for purifying air of claim 1 further comprising a pair of electrical prongs protruding from said device, said electrical prongs allowing said device to be directly plugged into an electrical outlet.

15 3. The device for purifying air of claim 1 wherein said photocatalyst is primarily titanium dioxide.

4. The device for purifying air of claim 3 wherein said titanium dioxide is doped with a dopant.

20 5. The device for purifying air of claim 4 wherein said dopant is platinum.

6. The device for purifying air of claim 1 further comprising a means for controlling humidity in said reactor.

25 7. The device for purifying air of claim 1 further comprising a fibrous mass located in said reactor, said fibrous mass holding said photocatalyst.

8. The device for purifying air of claim 7 wherein said fibrous mass is fiber glass.

30 9. The device for purifying air of claim 1 wherein said ultraviolet light source emits light of wavelength shorter than 387 nanometers.

35 10. A compact device with a base and a top for purifying air that is plugged directly into a wall power outlet comprising a set of power prongs protruding from the device for plugging into the wall outlet, a compartment containing a photocatalyst that is illuminated by an ultraviolet light source, an opening at the base of the device for air to enter, a heater means in the device near this opening for heating air entering the device and causing

this air to rise past the illuminated photocatalyst, the air becoming purified, and an exit port at the top of the device for the purified air to exit.

5 11. The compact device of claim 10 where the photocatalyst is primarily titanium dioxide.

12. The compact device of claim 11 where the titanium dioxide is doped with platinum.

13. The compact device of claim 11 where the ultraviolet light source emits light of wavelength shorter than 400 nanometers.

10 14. The compact device of claim 13 where the ultraviolet light source emits light of wavelength longer than 350 nanometers, the light source also producing visible light.

15. The compact device of claim 14 further comprising a means for allowing the visible light to escape.